1. What are the *possible Rational* roots of the polynomial below?

$$f(x) = 7x^4 + 2x^3 + 2x^2 + 2x + 6$$

A. $\pm 1, \pm 7$

B. All combinations of: $\dfrac{\pm 1, \pm 7}{\pm 1, \pm 2, \pm 3, \pm 6}$

C. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 3, \pm 6}{\pm 1, \pm 7}$

D. $\pm 1, \pm 2, \pm 3, \pm 6$

E. There is no formula or theorem that tells us all possible Rational roots.

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2. What are the *possible Integer* roots of the polynomial below?

$$f(x) = 6x^4 + 6x^3 + 3x^2 + 2x + 4$$

A. $\pm 1, \pm 2, \pm 4$

B. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 3, \pm 6}{\pm 1, \pm 2, \pm 4}$

C. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 4}{\pm 1, \pm 2, \pm 3, \pm 6}$

D. $\pm 1, \pm 2, \pm 3, \pm 6$

E. There is no formula or theorem that tells us all possible Integer roots.

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3. Factor the polynomial below completely, knowing that $x + 5$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 8x^4 - 14x^3 - 167x^2 + 455x - 300$$

A. $z_1 \in [-4.25, -3.95]$, $z_2 \in [-0.88, -0.53]$, $z_3 \in [-0.67, -0.65]$, and $z_4 \in [4.9, 5.1]$

B. $z_1 \in [-5.08, -4.64]$, $z_2 \in [0.79, 1.43]$, $z_3 \in [1.47, 1.53]$, and $z_4 \in [2.5, 4.4]$

C. $z_1 \in [-5.08, -4.64]$, $z_2 \in [-0.31, 0.74], z_3 \in [0.76, 0.84]$, and $z_4 \in [2.5, 4.4]$

D. $z_1 \in [-4.25, -3.95]$, $z_2 \in [-3.36, -2.87], z_3 \in [-0.63, -0.53]$, and $z_4 \in [4.9, 5.1]$

E. $z_1 \in [-4.25, -3.95]$, $z_2 \in [-2.41, -0.84], z_3 \in [-1.26, -1.22]$, and $z_4 \in [4.9, 5.1]$

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4. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{4x^3 - 12x + 6}{x + 2}$$

A. $a \in [3, 8], b \in [-13, -10], c \in [15, 25]$, and $r \in [-67, -61]$.

B. $a \in [3, 8], b \in [8, 10], c \in [-1, 8]$, and $r \in [8, 15]$.

C. $a \in [-10, -4], b \in [10, 17], c \in [-48, -42]$, and $r \in [94, 97]$.

D. $a \in [3, 8], b \in [-9, 0], c \in [-1, 8]$, and $r \in [-5, 4]$.

E. $a \in [-10, -4], b \in [-20, -15], c \in [-48, -42]$, and $r \in [-85, -81]$.

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5. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{20x^3 - 63x^2 + 23}{x - 3}$$

A. $a \in [57, 65], b \in [113, 120], c \in [350, 355]$, and $r \in [1074, 1078]$.

B. $a \in [17, 22], b \in [-130, -118], c \in [369, 371]$, and $r \in [-1085, -1082]$.

C. $a \in [57, 65], b \in [-245, -241], c \in [729, 731]$, and $r \in [-2169, -2161]$.

D. $a \in [17, 22], b \in [-5, 0], c \in [-13, -7]$, and $r \in [-6, 4]$.

E. $a \in [17, 22], b \in [-29, -22], c \in [-47, -42]$, and $r \in [-70, -68]$.

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6. Factor the polynomial below completely, knowing that $x-5$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 12x^4 - 113x^3 + 338x^2 - 395x + 150$$

A. $z_1 \in [-5.35, -4.91]$, $z_2 \in [-6.33, -4.95]$, $z_3 \in [-2.42, -1.69]$, and $z_4 \in [-0.34, -0.14]$

B. $z_1 \in [-5.35, -4.91]$, $z_2 \in [-2.13, -1.6]$, $z_3 \in [-1.8, -1.62]$, and $z_4 \in [-0.84, -0.74]$

C. $z_1 \in [0.72, 1.07]$, $z_2 \in [1.35, 1.95]$, $z_3 \in [1.61, 2.61]$, and $z_4 \in [4.79, 5.08]$

D. $z_1 \in [0.59, 0.69]$, $z_2 \in [1.11, 1.62]$, $z_3 \in [1.61, 2.61]$, and $z_4 \in [4.79, 5.08]$

E. $z_1 \in [-5.35, -4.91]$, $z_2 \in [-2.13, -1.6]$, $z_3 \in [-1.44, -1.27]$, and $z_4 \in [-0.68, -0.44]$

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7. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 25x^3 - 100x^2 - 4x + 16$$

A. $z_1 \in [-4.6, -3.3]$, $z_2 \in [-2.65, -2.36]$, and $z_3 \in [2.09, 3]$

B. $z_1 \in [-2.9, -2.4]$, $z_2 \in [1.93, 2.94]$, and $z_3 \in [3.93, 4.24]$

C. $z_1 \in [-4.6, -3.3]$, $z_2 \in [-2.25, -1.76]$, and $z_3 \in [-0.2, 0.15]$

D. $z_1 \in [-1.6, 0.4]$, $z_2 \in [0.19, 0.79]$, and $z_3 \in [3.93, 4.24]$

E. $z_1 \in [-4.6, -3.3]$, $z_2 \in [-0.56, -0.04]$, and $z_3 \in [0.11, 1.11]$

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8. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 20x^3 + 31x^2 - 38x - 40$$

A. $z_1 \in [-0.92, -0.65]$, $z_2 \in [1.12, 1.47]$, and $z_3 \in [1.78, 2.59]$

B. $z_1 \in [-5.08, -4.9]$, $z_2 \in [-0.09, 0.27]$, and $z_3 \in [1.78, 2.59]$

C. $z_1 \in [-1.46, -1.02]$, $z_2 \in [0.78, 1.08]$, and $z_3 \in [1.78, 2.59]$

D. $z_1 \in [-2.2, -1.8]$, $z_2 \in [-1.59, -1.18]$, and $z_3 \in [0.41, 0.86]$

E. $z_1 \in [-2.2, -1.8]$, $z_2 \in [-0.86, -0.52]$, and $z_3 \in [1.1, 1.49]$

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9. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{6x^3 - 2x^2 - 20x + 19}{x + 2}$$

A. $a \in [-15, -8]$, $b \in [-28, -25]$, $c \in [-72, -68]$, and $r \in [-132, -124]$.

B. $a \in [-15, -8]$, $b \in [22, 24]$, $c \in [-66, -63]$, and $r \in [144, 149]$.

C. $a \in [1, 11]$, $b \in [-21, -19]$, $c \in [34, 46]$, and $r \in [-103, -97]$.

D. $a \in [1, 11]$, $b \in [8, 17]$, $c \in [-3, 4]$, and $r \in [15, 20]$.

E. $a \in [1, 11]$, $b \in [-14, -9]$, $c \in [7, 9]$, and $r \in [2, 4]$.

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10. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{6x^3 - 20x^2 - 2x + 19}{x - 3}$$

A. $a \in [5, 9]$, $b \in [-40, -34]$, $c \in [111, 115]$, and $r \in [-322, -313]$.

B. $a \in [15, 21]$, $b \in [-76, -72]$, $c \in [218, 224]$, and $r \in [-646, -637]$.

C. $a \in [5, 9]$, $b \in [-14, -3]$, $c \in [-23, -16]$, and $r \in [-18, -15]$.

D. $a \in [5, 9]$, $b \in [-6, 6]$, $c \in [-15, -7]$, and $r \in [-6, -3]$.

E. $a \in [15, 21]$, $b \in [29, 35]$, $c \in [95, 104]$, and $r \in [318, 321]$.
